UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA

June 9, 2017

George ("Pat") Brooks
US Department of the Navy
33000 Nixie Way, Bldg 50
San Diego, CA 92147

Dear Pat:

Thank you for the hard work and deep thought that went into crafting the Draft Data Evaluation Documentation and Findings form that you presented on May 5, 2017, and May 24, 2017. The thorough approach that you have developed includes multiple lines of evidence to identify trench units (TUs)/survey units (SUs) which may need to be investigated further to determine if radiological clearance had been manipulated. This is a solid approach coupled with logical tests, historical information, personal accounts, and effective statistical evaluation and data visualization. Visualization of the ROC data sets for all units using time series plots is helpful and represents a useful addition to Navy's evaluation approach. Attached are USEPA comments on the proposed approach that are intended to increase likelihood of correct identification of potential falsification during this analysis.

As we have stated previously in EPA's January 11, 2017, comments on the original draft of the Workplan, "Where data quality is reliable, statistical tests are indeed another tool to find new evidence of potential falsification in previously undiscovered anomalies. However, prior data may also be unreliable because prior potential falsification has unknown scope. . . . Sampling in many areas will be necessary regardless of the findings of the statistical tests." I understand that the Navy is working on a robust sampling plan and that proposed sampling locations will be informed by the data evaluation as well as other factors, including many of those listed in USEPA's March 23, 2017, list of categories of concerns.

I look forward to continuing to work together on addressing this priority issue. Please contact me at 415-947-4187 or lee.lily@epa.gov if you would like to discuss any of these comments.

Sincerely,

Lily Lee, Remedial Project Manager

Attachment

cc. Juanita Bacey, State Department of Toxic Substances Control
Tina Ures, Regional Water Quality Control Board
Amy Brownell, San Francisco Department of Public Health

USEPA Comments Regarding Navy Approach to Hunters Point Naval Shipyard
"Data Evaluation Documentation and Findings"
Presented on May 5, 2017, and May 24, 2017
Comments dated June 9, 2017

EPA supports the Navy's approach of using multiple lines of evidence to identify trench units (TUs)/survey units (SUs) which may need to be investigated further to determine if radiological clearance had been manipulated. This approach entails the completion of a "Data Evaluation Documentation and Findings" form. This is a solid approach when it includes logical tests, historical information, personal accounts, and effective statistical evaluation and data visualization methods. Visualization of the ROC data sets using univariate time-series plots is helpful and represents a useful addition to Navy's evaluation approach. Below are suggestions for making the statistical and graphical approaches more relevant to the objective of the investigation and provide more reliable and defensible results.

General Comments

1. Add Time Series plots for al ROC's: Limiting the evaluations to three ROCs (Bi-214, AC-228, and K-40) may not be sufficient to identify all potential falsification and data manipulation, as univariate time-series plots for one ROC at a time may not identify all potential patterns present in Hunters Point site data sets containing manipulated results. Please provide time-series plots for all ROC's relevant to a given SU/TU.

2. Use of Individual Box Plots and Q-Q Plots: The Navy has planned to use univariate methods including the K-S test, summary statistics, time-series plots, box plots and Q-Q plots. Out of these planned univariate methods, time-series graphs supplemented with weight of evidence (WOE) and logic tests may be successful in identifying anomalous behavior in data sets potentially representing data manipulation/falsification. Individual box plots and Q-Q plots as used in May 24th, 2017, meeting represent important tools in identifying extreme outliers (e.g., representing contamination), data distributions and data variability. However, these graphs cannot effectively accomplish the key objective of identifying falsification, which requires comparison of data collected during sampling phases (and collection dates). In general, extreme outliers do not represent falsified activities and are expected in collected data sets (e.g., during Sys-1 and Sys-2 sampling phases) given the nature of the site.

   Univariate Side-by-Side Box Plots and Multiple Q-Q Plots on the Same Graph: EPA recommends using univariate side-by-side box plots and multiple Q-Q plots (described below) to determine anomalous activities that might have occurred during one or more sampling phases or data collection dates. In addition, to quickly identifying anomalous activities, the use of side-by-side box plots and multiple Q-Q plots will address the issue of generating graphs using the same scale along the y-axis across all sampling events (e.g., sampling phases - Sys-1, Bias-FSS, SYS-FSS, Sys-2) and sample collection dates. These graphs will provide a quick comparison of data variability in data sets collected during different sampling phases/collection dates. An unusual and/or unexpected pattern observed in data variability noted in these graphs (e.g., illustrated in Figures 1 and 2 below) will lead to identifying potential falsified activities.

   The use of these graphs will make the process more transparent and will reduce the subjectivity involved in a decision-making process based only upon univariate time-series plots.

   Examples: It has already been established that data from SU-1 of North Pier was falsified during sampling phase Sys-2. For ROCs: K-40 and Bi-214, the proposed side-by-side box plots and multiple Q-Q plots are displayed in Figures 1 and 2. Figure 1 has univariate side-by-side box plots for K-40 for the five sampling phases for SU-1, and Figure 2 has multiple Q-Q plots for Bi-214 values reported during the five sampling phases.

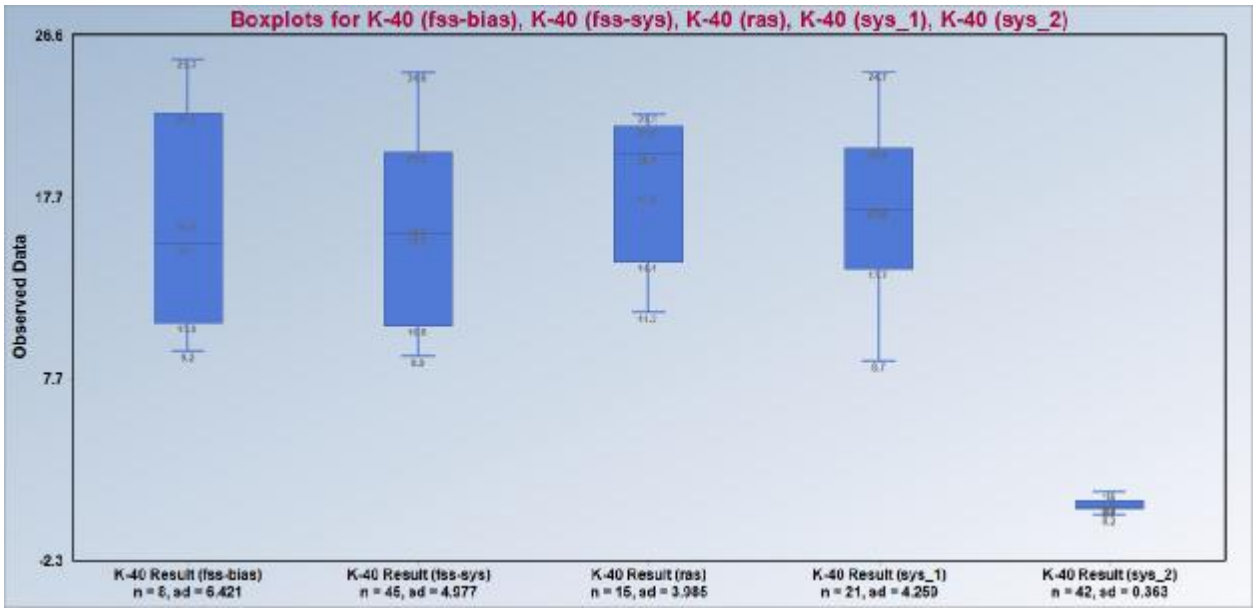

Figure 1. Side-by-Side Box Plots for K-40 Reported During the Five Sampling Phases (SU-1, North Pier)

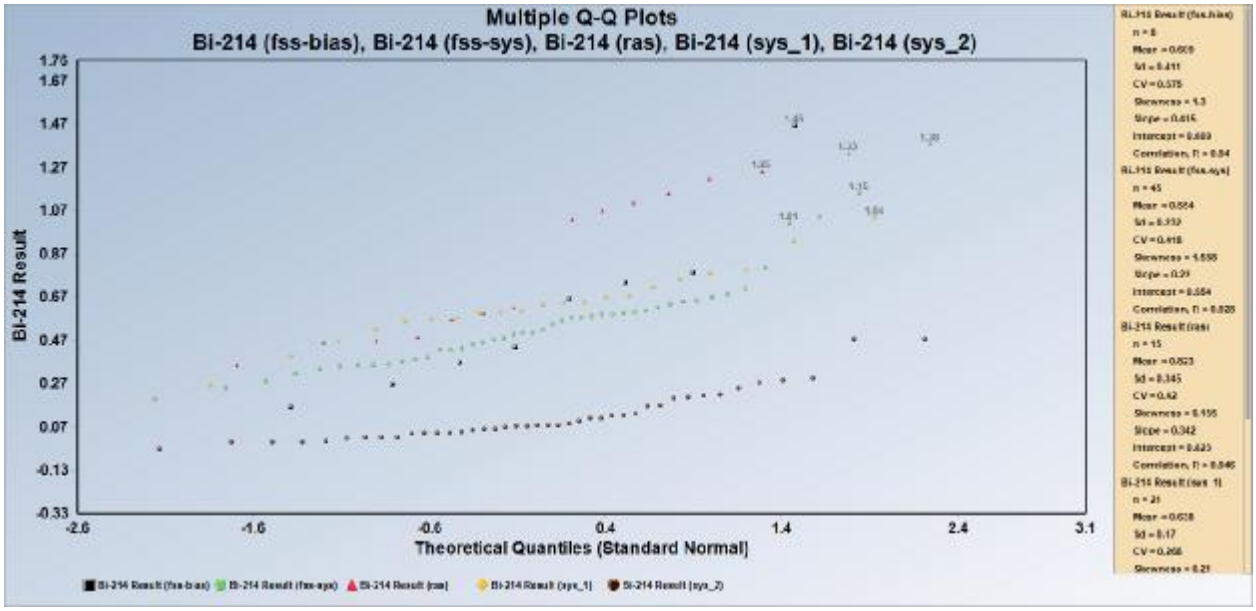

Figure 2. Multiple Q-Q Plots for Bi-214 Reported During the Five Sampling Phases (SU-1, North Pier)

Univariate graphs shown in Figures 1 and 2 not only provide graphical comparison of data (in the same scale) collected during the various sampling phases (similar graphs can be generated for other collection dates) but also provide visual comparison of variability simultaneously for all sampling phases in the same scale. These graphs quickly lead to the conclusion that something abnormal/unusual took place during the sampling phase: Sys-2.

Box plots (Figure 3) and Q-Q plots (Figure 4) as used during the May 24, 2017, presentation could provide more useful information to improve understanding of the anomalous observations present in SU-1 data sets. Figure 3 has a box plot for the combined K-40 data set and Figure 4 has a Q-Q plot based upon the combined Bi-214 data set. Similar graphs can be generated individually by sampling phases or by using combined data from two or more sampling phases which may not add any useful information.

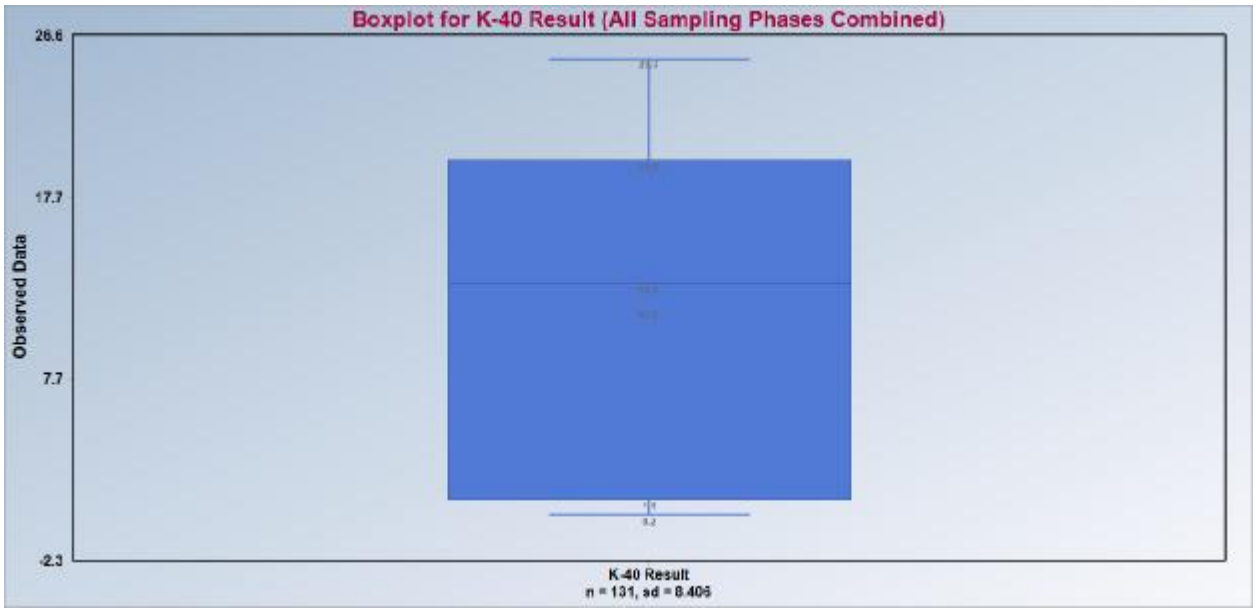

Figure 3. Box Plot Based Upon the Combined K-40 Data Reported During the Five Sampling Phases (SU-1, North Pier)

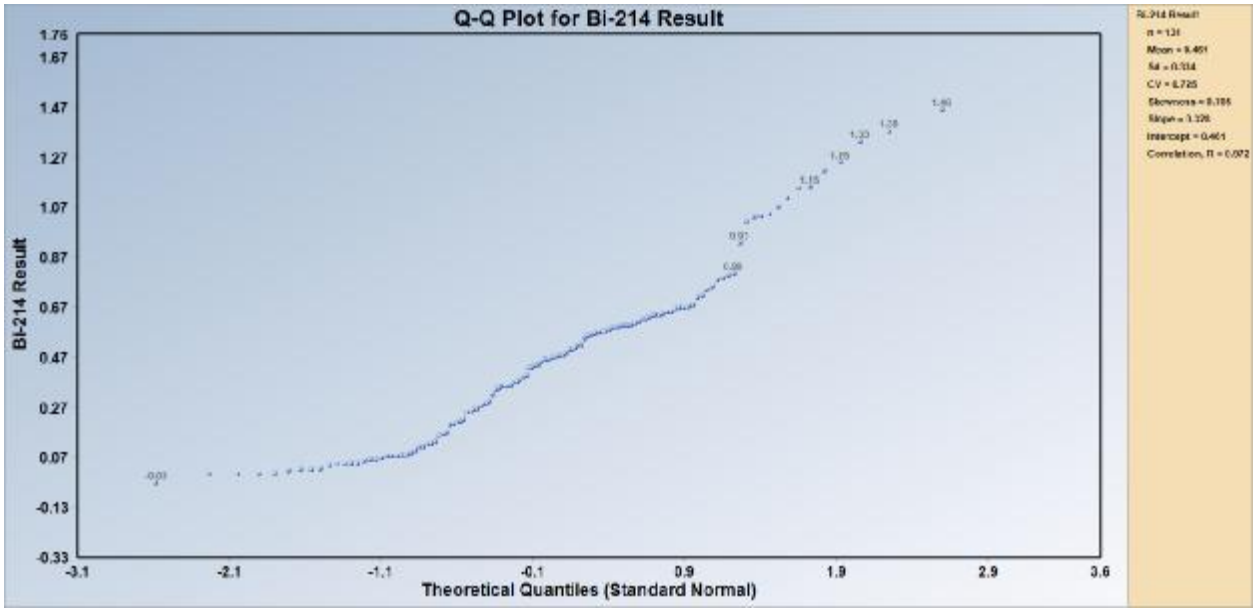

Figure 4. Q-Q Plot Based Upon the Combined Bi-214 Data Reported During the Five Sampling Phases (SU-1, North Pier)

The box plot displayed in Figure 3 does not provide any information about the falsification that took place during Sys-2 phase. Looking at the graph shown in Figure 3, one can conclude that the K-40 data set is very well behaved without any anomalies. The Q-Q plot displayed in Figure 4 identifies some high observations shown in the upper end of the graph; however, this graph does not provide any indication of falsification that took place during Sys-2 phase.

Suggestions: Instead of using individual box plots/Q-Q plots (for each sampling phase or for two or more sampling phases combined), EPA recommends using univariate side-by-side box plots (Figure 1) or univariate multiple Q-Q plots (Figure 2); these graphs provide visual comparison of ROC data by sampling phases (and by collection dates) and estimates of variabilities for all sampling phases in the same scale. Any one of the two graphs (Figure 1 or Figure 2) can be used to perform visual comparisons and assess variabilities of data collected during sampling phases.

3. EPA supports the Navy's approach of using multiple lines of evidences for all SU's/TU's associated with Tetra Tech, EC., Inc., regardless of results of the K-S test. As mentioned before, the repeated use (many comparisons) of the K-S test on a parcel may not effectively identify all instances of falsification if used alone without consideration of other lines of evidence. Multivariate time-series plots for all ROCs per SU would provide more information and an easier and more effective way to identify patterns present within the data sets. EPA will, therefore, prepare these for a strategically chosen subset of SU/TU's as part of its oversight role.